REMARKS

Claims 26, 27, and 28 have been amended to more clearly describe Applicants' invention. In particular, each of these claims has been amended to recite that the atmosphere is flowing substantially against the direction of gravity. Support for this amendment can be found throughout the present specification, including, for example, page 5, 2nd and 4th full paragraphs; page 6, 2nd, 3rd, and 5th full paragraphs; and Example 1. No new matter has been added. Thus, claims 14-22 and 26-28 are pending.

Double Patenting

Claims 14-22 and 26-28 have been provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over claims 19-23, 27-31, 33-34, and 36 of copending U.S. Patent Application No. 09/444,469.

On pages 1-2, the Office Action states that, although the conflicting claims are not identical, they are not patentably distinct from each other because the present claims do not exclude the forming condensate as required in the claims of the copending application.

As noted in the Office Action, this is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented. Therefore, Applicants believe it would be best to permit the present application to issue into a patent and address this rejection when U.S. Patent Application No. 09/444,469 is further examined, or vice versa. The undersigned notes that this is acceptable under the guidelines set forth in the MPEP.

Rejection of Claims under 35 U.S.C. § 112

Claim 14-22 and 26-28 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In particular, on page 2, the Office Action states that it is unclear what flows substantially against the direction of gravity, the lyosol or the atmosphere.

The Office Action also notes that, unless specified otherwise, it is assumed that the lyosol flows against the direction of gravity.

Applicants respectfully disagree. Based on the disclosure provided throughout the present application, Applicants believe it is clear that the atmosphere is moving, i.e., flowing substantially against the direction of gravity. For example, the present specification states that gel forming components are mixed together to form a lyosol that is introduced into a "moving medium" and that the "moving atmosphere" greatly increases the dwell time of the lyosol particles in the medium (see page 5, 2nd and 4th full paragraphs). Also, according to a preferred embodiment of the present invention, the lyosol is added "to an air stream which flows substantially against the direction of gravity" and that this "air flow which is opposite to the direction of gravity can furthermore be used for grading or classifying of the drops or particles" (see page 6, 2nd full paragraph). Furthermore, the lyosol can be introduced into "an air flow, the velocity of which diminishes in the direction of flow", slowing the falling rate of the balls "due to the air flowing against the direction of fall" (see page 6, 3rd and 5th full paragraphs). Finally, Example 1 provides a specific air flow rate, stating that the "heated air flows vertically upward" (see the paragraph spanning pages 7 and 8).

Therefore, Applicants believe it is clear that the atmosphere is flowing substantially against the direction of gravity, and, as a result, the assumption upon which the Office Action is based is therefore incorrect.

In order to provide additional clarity, Applicants have amended claims 26, 27, and 28 to recite that the lyosol (in claims 26 and 27) or hydrosol (in claim 28) is introduced into an atmosphere flowing substantially against the direction of gravity. With this additional amendment, combined with the present disclosure, Applicants therefore believe the present claims are not indefinite and respectfully request that the rejection under 35 U.S.C. § 112, second paragraph, be withdrawn.

Rejection of Claims under 35 U.S.C. § 103

Marisic in view of Fernholz et al., optionally further in view of Mielke et al.

Claims 14-22, 26, and 28 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Marisic (U.S. Patent No. 2,384,946) in view of Fernholz et al. (U.S. Patent No. 3,939,199) and optionally further in view of Mielke et al. (U.S. Patent No. 5,656,195).

On page 3, the Office Action states that Marisic discloses a process of producing hydrogel pellets by continuously contacting within an enclosed mixing chamber such as an injector or nozzle mixer, streams of reactant solutions of such concentration and proportions that no gelation occurs within the mixer, but only at some predetermined time after leaving the mixer, and under such conditions of flow that each stream is completely and uniformly dispersed within and throughout the other at the instant of contact. The Office Action also states that the resultant colloidal solution is ejected from the mixer through an orifice or orifices of suitable size so as to form globules of the solution which are introduced into a fluid medium where the globules of the colloidal solution set to a gel before they pass out of the medium. The Office Action further identifies other features of Marisic, including the formation of pellets by a process analogous to spray drying wherein the gelable solution is sprayed into a drying tower, that the fluid medium can be constituted of a gas such as air, and that the medium may contain components which can be dissolved therefrom by the hydrosol, and concludes that it would have been obvious to one skilled in the art to select any embodiment among the specifically disclosed embodiments.

On pages 3-4, the Office Action also states that Marisic further discloses that the fluid medium is maintained at temperature below the boiling point of the sol and that, after setting is complete, the hydrogen may be washed, base exchanged, heat treated or otherwise processed to obtain the desired physical and chemical characteristics in the final product. The Office Action considers this product to be the same as the claimed aerogel since the resulting gel possesses open pores free of liquid.

While the Office Action notes that Marisic does not specifically disclose the temperature of the process, the conclusion is drawn that it would have been obvious to optimize these process conditions to obtain the best results and that it would have been obvious to dry the hydrogel to obtain aerogel, since aerogel is desired in the art. The Office Action adds that, in the event that the heat treating step of Marisic is not sufficient to convert the hydrogel to aerogel, Mielke et al. teaches that silica aerogel particles, which are desired to be used in moldings, can be produced by solvent exchange and subsequent supercritical drying of a silica hydrogel. The Office Action therefore concludes that it would have been obvious to one of ordinary skill in the art to convert the hydrogel of Marisic to aerogel because aerogel is desired to be used in moldings as suggested by Mielke et al.

On pages 4-5, the Office Action also notes that Marisic does not disclose that the fluid is moving substantially against the direction of gravity. However, the Office Action states that Fernholz et al. discloses that for a spray-drying process for converting a sol to a gel, in order to avoid damage of the gelled and still soft particles, they can be sprayed in an upward inclined direction and collected in a liquid bath (for example water) or they can be conducted in counter current flow with a current of air or gas which reduces their impact velocity and simultaneously improves their resistance by drying. The Office Action therefore concludes that it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a current of air or gas in counter current flow with the spray of silica sol in the process of Marisic, as suggested by Fernholz et al. because such counter current flow of air would reduce the silica gels impact velocity and improve their resistance by drying.

On page 5, regarding claim 20, the Office Action further concludes that the subject matter as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to have used both the water bath and the counter current flow of air to avoid damage of the gelled and still soft particles, because combining two or more ways as disclosed in Fernholz et al. for the same purpose has been held to be a prima facie case of obviousness.

Applicants continue to respectfully disagree. Regarding claims 14-22 and 26, claim 26 recites a method of producing substantially globular aerogels wherein gel forming components are mixed to produce a lyosol, the lyosol is introduced into an atmosphere flowing substantially against the direction of gravity to form a substantially globular lyogel, and the substantially globular lyogel is converted to an aerogel.

As noted in the Office Action, Marisic does not disclose that the fluid is moving substantially against the direction of gravity. For this reason, Fernholz et al. has been applied for the countercurrent flow method used to minimize damage to the described "gelled and still soft particles" and used to finally conclude that it would have been obvious to use this method in the process of Marisic because such countercurrent flow would reduce the silica gels' impact velocity and would improve their resistance by drying.

However, Applicants continue to believe that these references would not be combined by one skilled in the art. As acknowledged by the Office Action mailed October 11, 2006, Fernholz et al. and Marisic each relate to very different types of particles – the sol or gel of Fernholz et al. is not silica as in Marisic. While the Office Action also states that, since Fernholz et al. discloses a spray-drying process for converting a sol to a gel in which spraying occurs in an upward inclined direction or using a countercurrent flow of air or gas, in order to avoid damage to the gelled and still soft particles, Applicants continue to believe that one skilled in the art would not apply the countercurrent flow of Fernholz et al. to the silica sol or gel of Marisic. Rather, Applicants believe that Marisic clearly teaches that such a countercurrent flow would not be possible with the gels prepared in the described process.

For example, Marisic teaches that, "[w]hether the fluid medium is gaseous or liquid, it is essential to the formation of a structurally strong pellet that the sol not be mechanically disturbed during the time of setting" (see page 2, second column, lines 1-5). Even evaporation of water from the sol "disturbs the gel structure during formation" (see page 2, second column, lines 5-14). Also, the shape of the formed gel is affected by the type of fluid medium and the rate at which the colloidal solution travels through it (see page 2, second column, lines 56-66). Thus,

the globules of the sol can result in gel having flat or disc-like shapes, depending on the medium, thereby loosing their spherical shape.

In addition, while, as noted in the present Office Action, Marisic teaches a flow against gravity, there is no description that the medium (the atmosphere) flows against the direction of gravity, as is specifically recited in the present claims. In particular, Figure 4 of Marisic shows an embodiment in which the apparatus is adapted for upward flow of the colloidal solution during gelation (see page 3, second column, lines 67-75). While the colloidal solution flows upward, the medium is stationary. Thus, there is no countercurrent flow, in which the flow of the colloidal solution goes against the flow of the medium. Such an embodiment is completely consistent with the requirement stated in Marisic that "the sol not be mechanically disturbed during the time of setting".

Since Marisic clearly teaches that the spherical sols become damaged or can lose their shape if mechanically disturbed, one skilled in the art would avoid using any method which would disturb the sol, and this would include the countercurrent flow of Fernholz et al. Thus, Fernholz et al. does not suggest a solution that can be applied to the sol of Marisic, and therefore Applicants believe that one skilled in the art would not combine the teachings of these references, thereby arriving at the present invention.

Regarding Mielke et al., Applicants believe that this reference also cannot cure the deficiencies of Marisic. In particular, while Mielke et al. shows that a silica aerogel can be produced by solvent exchange and subsequent supercritical drying of a silica hydrogel, there is no teaching or suggestion anywhere in Mielke et al. of a process in which a lyosol is introduced into an atmosphere flowing substantially against the direction of gravity. Furthermore, while the Office Action states that this reference teaches that aerogel particles are desired to be used in moldings, none of the present claims recites a molding.

Therefore, since Marisic cannot be combined with Fernholz et al. and since Mielke et al. cannot cure the deficiencies of Marisic, Applicants believe that claim 26 is patentable over Marisic in view of Fernholz et al. and optionally further in view of Mielke et al. In addition, claims 14-22, which depend either directly or indirectly from claim 26, recite further embodiments of the present invention and, for at least the reasons discussed above, are also patentable over this combination of references.

Regarding claim 28, this claim recites a method of producing substantially globular aerogels wherein gel forming components are mixed to produce a hydrosol, the hydrosol is introduced into an atmosphere flowing substantially against the direction of gravity to form a substantially globular hydrogel, and the substantially globular hydrogel is converted to an aerogel. The hydrosol is formed from silicic acid and mineral acid, and the substantially globular hydrogel is trapped in a layer of water. Applicants believe that claim 28 is also patentable over Marisic in view of Fernholz et al., optionally further in view of Mielke et al. for at least the reasons discussed above. In addition, there is no disclosure in Fernholz et al. of either the formation of a hydrosol from silicic acid and mineral acid or of trapping substantially globular hydrogels in a layer of water. Therefore, Applicants believe that claim 28 is patentable over this combination of references.

Applicants therefore believe that claims 14-22, 26, and 28 are patentable over Marisic in view of Fernholz et al., optionally further in view of Mielke et al., and respectfully request that the rejection of these claims under 35 U.S.C. § 103(a) be withdrawn.

EP 0 687 199 in view of Mielke et al.

Claims 14-22, 26, and 28 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over EP 0 687 199 (EP '199, with a translation provided) in view of Mielke et al. (U.S. Patent No. 5,656,195).

On page 5, the Office Action states that EP '199 discloses a method of producing spherical particles made from inorganic oxides by means of a sol/gel conversion in which a sol is sprayed from below into a reaction zone containing a reactant gas in such a manner that the sol does not split open into individual sol droplets until immediately before or as it enters the reaction zone and the formed sol droplets fly through the reaction zone on a curved trajectory while being solidified forming presolidified sol particles that are then caught in a trap. The Office Action also describes additional details regarding EP '199, which are fully incorporated by reference herein, including that a) the sol is injected from the spraying device from below, that is, against the force of gravity, b) the sol droplets eventually switch from an upward to a downward flow, which fairly shows that the flow is diminishing in the direction of the flow, c) the gel can be collected in a vessel filled with a fluid, such as water, d) the upward flow in EP '199 would inherently have the classifying action (i.e., screening) as required by present claim 18, e) EP '199 fairly teaches, with sufficient specificity, the step of forming an instable sol by mixing silicon dioxide or sodium silicate with hydrochloric acid, and f) in addition to the alkaline and acid reactant gases, when self-gelling sols are used, inert gases such as air or nitrogen may also be used as the reactant gases.

Furthermore, the Office Action states that EP '199 also teaches that, in the case of a very narrow distance of the spraying device from the inlet opening of the reaction zone containing the reactant gas, it may be expedient for spraying nozzles or hollow needles with a small diameter to blow rinsing gas (such as compressed air or water vapor) at the spraying device in order to avoid a clogging of the spraying device by prematurely gelling sol. The Office Action concludes that this fairly teaches the presence of steam, which is considered as being "completely miscible with the lyosol" and that such steam would inherently form condensate on the lyosol.

Finally, the Office Action states that when air is used as a purge gas, the stream containing the air and sol is considered as an atmosphere containing sol, or, alternatively, when the sol is sprayed into the medium contained in the reaction zone, the flow of lyosol disturbs and displaces the air in the atmosphere in the reaction zone to cause a flow of air in the same direction (i.e., against gravity).

On page 8, the Office Action states that EP '199 does not disclose the step of converting the hydrogel into an aerogel. However, the Office Action also states that Mielke et al. is applied, as described above, to teach the step of converting the hydrogel into aerogel so that the aerogel can be used in a molding application.

Applicants respectfully disagree. Claims 26 and 28 recite a method of producing substantially globular aerogels wherein gel forming components are mixed to produce a lyosol (for claim 26) or hydrosol (for claim 28), which is introduced into an atmosphere flowing substantially against the direction of gravity to form a substantially globular lyogel (for claim 26) or hydrogel (for claim 28), and this is then converted to an aerogel.

By comparison, and as noted in the Office Action, EP '199 discloses a method of producing spherical particles made from inorganic oxides by means of a sol/gel conversion in which a sol is sprayed from below into a reaction zone. There is no disclosure, teaching, or suggestion anywhere in this reference of introducing a lyosol into an atmosphere flowing in a direction substantially in opposition to the force of gravity to form a substantially globular lyogel. Rather, this reference describes a method in which the lyosol is sprayed in a direction substantially in opposition to the force of gravity into a vapor phase (a reactant gas) that is stationary and not flowing in a direction opposite to the force of gravity. Thus, in EP '199, the lyosol is flowing against gravity, not the atmosphere, which is fundamentally different from the method recited in present claim 26.

Regarding Mielke et al., Applicants believe that this reference cannot cure the deficiencies of EP '199. In particular, while Mielke et al. shows that a silica aerogel can be produced by solvent exchange and subsequent supercritical drying of a silica hydrogel, there is no teaching or suggestion anywhere in Mielke et al. of a process in which a lyosol is introduced into an atmosphere flowing substantially against the direction of gravity. Furthermore, while the Office Action states that this reference teaches that aerogel particles are desired to be used in moldings, none of the present claims recites a molding.

Therefore, since EP '199 does not disclose, teach, or suggest an atmosphere flowing in a direction substantially in opposition to the force of gravity, and since Mielke et al. cannot cure the deficiencies of EP '199, Applicants believe that claims 26 and 28 are patentable over this combination of references. In addition, claims 14-22, which depend either directly or indirectly from claim 26, recite further embodiments of the present invention and, for at least the reasons discussed above, are also patentable over EP '199 in view of Mielke et al.

Applicants therefore believe that claims 14-22, 26, and 28 are patentable over EP '199 in view of Mielke et al. and respectfully request that the rejection of these claims under 35 U.S.C. § 103(a) be withdrawn.

Marisic in view of Fernholz et al. and Frank et al.

Claim 27 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Marisic (U.S. Patent No. 2,384,946) in view of Fernholz et al. (U.S. Patent No. 3,939,199) and Frank et al. (U.S. Patent No. 5,789,075).

On page 8, the Office Action states that Marisic and Fernholz et al. are applied as stated in the rejection above and notes that the difference not yet discussed is that Marisic does not teach the silylation step. For this reason, the Office Action refers to Frank et al, stating that this reference discloses that the term aerogel encompasses xerogels and cryogels and that it is known in the art to convert gels into xerogels by modifying the gels by silylation in such a way that the gels can be dried without collapsing. The Office Action therefore concludes that it would have been obvious to one of ordinary skill in the art to convert the gel of Marisic into an aerogel (i.e., xerogel) by first silylating the gel, as suggest by Frank et al. in order to dry the gel without collapsing the gel structure because Frank et al. teaches that aerogel is a desired product in the art.

Applicants respectfully disagree. Claim 27 recites a method of producing substantially globular silylated lyogels wherein gel forming components are mixed to produce a lyosol, the lyosol is introduced into an atmosphere flowing substantially against the direction of gravity to form a substantially globular lyogel, and the substantially globular lyogel is reacted with a silylating agent to form a substantially globular silylated lyogel. As discussed in more detail above, since Marisic clearly teaches that the spherical sols become damaged or can lose their shape if mechanically disturbed, Applicants believe that one skilled in the art would avoid using any method which would disturb the sol, which would include the countercurrent flow of Fernholz et al. Thus, Fernholz et al. does not suggest a solution that can be applied to the sol of Marisic, and, as a result, Applicants believe that one skilled in the art would not combine the teachings of these references.

In addition, regarding Frank et al., Applicants believe that this reference cannot cure the deficiencies of Marisic. In particular, while Frank et al. does disclose that hydrogels may be modified by silylation, there is no teaching or suggestion anywhere in Frank et al. of a process in which a lyosol is introduced into an atmosphere flowing substantially against the direction of gravity.

Therefore, since Marisic cannot be combined with Fernholz et al. and since Frank et al. cannot cure the deficiencies of Marisic, Applicants believe that claim 27 is patentable over Marisic in view of Fernholz et al. and Frank et al. and respectfully request that the rejection of this claim under 35 U.S.C. § 103(a) be withdrawn.

EP '199 in view of Frank et al.

Claim 27 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over EP 0 687 199 (EP '199, with a translation provided) in view of Frank et al. (U.S. Patent No. 5,789,075).

On page 9, the Office Action states that EP '199 is applied as stated in the rejection above and notes that the difference is that EP '199 does not teach the silylation step. For this reason, the Office Action refers to Frank et al., applied as stated above to teach the silylating step.

Applicants respectfully disagree. Claim 27 recites a method of producing substantially globular silylated lyogels wherein gel forming components are mixed to produce a lyosol, the lyosol is introduced into an atmosphere flowing substantially against the direction of gravity to form a substantially globular lyogel, and the substantially globular lyogel is reacted with a silylating agent to form a substantially globular silylated lyogel. As discussed in more detail above, EP '199 does not disclose, teach, or suggest an atmosphere flowing in a direction substantially in opposition to the force of gravity, but rather describes a fundamentally different method in which the lyosol is flowing against gravity (sprayed from below) and the atmosphere (a reactant gas) is stationary.

In addition, regarding Frank et al., Applicants believe that this reference cannot cure the deficiencies of EP '199. In particular, while Frank et al. does disclose that hydrogels may be modified by silylation, there is no teaching or suggestion anywhere in Frank et al. of a process in which a lyosol is introduced into an atmosphere flowing substantially against the direction of gravity.

Therefore, since EP '199 describes a very different process from that of claim 27, and since Frank et al. cannot cure the deficiencies of EP '199, Applicants believe that claim 27 is patentable over EP '199 in view of Frank et al. and respectfully request that the rejection of this claim under 35 U.S.C. § 103(a) be withdrawn.

Conclusion

In view of the foregoing remarks, Applicants believe that this application is in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would further expedite the prosecution of the subject application, the Examiner is invited to call the undersigned.

Respectfully submitted,

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